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IS : 10038 - 1981

Indian Standard
SPECIFICATION FOR
TEXTURED PLANT PROTEIN FOODS
PREPARED BY EXTRUSION COOKING

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Indian Standard

SPECIFICATION FOR TEXTURED PLANT PROTEIN FOODS PREPARED BY EXTRUSION COOKING

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Indian Standard

SPECIFICATION FOR
TEXTURED PLANT PROTEIN FOODS
PREPARED BY EXTRUSION COOKING

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 31 December 1981, after the draft finalized by the Nutrition Sectional Committee had been approved by the Agricultural and Food Products Division Council.

0.2 Textured plant protein foods are products in which the proteinaceous raw materials have been modified by a process known as extrusion cooking. The moistened proteinaceous materials are plasticized in a tube by a combination of moisture, pressure, heat and mechanical shear as the material passes, through dies, from a high pressure point to atmospheric pressure. The product is cut into pieces of required size and then dried to a suitable moisture level.

0.3 These products have use as a source of protein in the diet. They can be used as meat extenders in non-vegetarian diets to make the food economical, and as a good source of protein in vegetarian diets. Introduction of these products has opened a new way of using vegetable proteins (especially oil meal proteins), in human diets, by conversion into an acceptable food product by a thermally efficient process.

0.4 A few manufacturers have introduced textured plant protein foods in the Indian market. To protect the consumer and at the same time to provide guidelines for manufacture of such foods, it has been thought timely to prescribe quality requirements for this product.

0.5 This standard does not define any particular plant raw material or mixture of raw materials but leaves the option open to the manufacturer. This standard specifies only the minimum level of food nutrient in the product, the quality of protein, and the product texture. Levels of anti-nutritional factors are also laid down.

0.6 While formulating this standard, necessary consideration has been given to the relevant Rules prescribed under the *Prevention of Food Adulteration Act, 1954* and the *Standards of Weights and Measures (Packaged*

Commodities) Rules, 1977. This standard is however subject to restrictions imposed under these wherever applicable.

0.7 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard prescribes the requirements and methods of sampling and test for textured plant protein foods (TPPF) prepared by extrusion cooking.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions shall apply.

2.1 Type Test — Tests to provide the conformity of requirements to this standard. They are intended to approve the formulation and quality of the product at least in the beginning of marketing and/or certification. These tests may also be conducted whenever the basic formulation is changed.

2.2 Acceptance Test — Tests carried out on samples selected from the lot for the purpose of acceptance of the lot.

3. REQUIREMENTS

3.1 The following raw material, singly or in combination (having protein content not less than 45 percent) may be used for the production of TPPF. They should be clean and of good quality and should conform to the relevant Indian Standards:

- a) Edible oilseed meals, concentrates and isolates;
- b) Cereals and *DHALS*; and
- c) Protein concentrates and isolates.

3.2 Description — The method of production shall be extrusion cooking. The TPPF may be in different shapes and sizes depending upon the die used. It shall however be reasonably uniform in shape and

*Rules for rounding off numerical values (*revised*).

size. The product shall be fully cooked and shall have an acceptable mouth feel and flavour. It shall also be free from extraneous matter and harmful material. The TPPF shall be processed under hygienic conditions as prescribed in IS : 2491-1972*.

3.3 Water Absorption Capacity — A 10-gram sample of the product shall absorb at least 20 grams of water under the test conditions specified in Appendix A.

3.4 Texture Stability — The TPPF shall pass the hydration, grinding and sieve-retention test described in Appendix B.

3.5 Flavour and Colour — Flavour and colour permitted under the *Prevention of Food Adulteration Act, 1954* may be added. The unflavoured product shall have an acceptable flavour.

3.6 The TPPF shall also comply with the requirement given in Table 1.

3.6.1 Protein Efficiency Ratio (PER) — The PER of the TPPF shall not be less than 1·8 (corrected PER) when determined by the method given in IS : 7481-1974†.

3.6.2 Aflatoxin — The aflatoxin content of the TPPF shall not be more than 30 $\mu\text{g}/\text{kg}$ when tested according to the method prescribed in Appendix K of IS : 4684-1975‡.

3.6.3 Gossypol — The TPPF shall not have a free gossypol content of more than 0·06 percent by mass and total gossypol contents more than 1·2 percent by mass, when tested according to the method prescribed in Appendix A of IS : 4874-1968§.

3.6.4 Urease Activity — The TPPF shall not show a change in *pH* by more than 0·5 when determined by the method given in Appendix D of IS : 7837-1975||.

3.6.5 Oxalic Acid — The oxalic acid content of TPPF shall not exceed 0·5 percent, when tested according to the method prescribed in Appendix B of IS : 6109-1971¶.

NOTE — Aflatoxin content, gossypol content, urease activity and oxalic acid content shall be determined only if flours of groundnut, cottonseed, soya and sesame, respectively have been used in making the TPPF.

*Code for hygienic conditions for food processing units (*first revision*).

†Method for determination of protein efficiency ratio (PER).

‡Specification for edible groundnut flour (expeller pressed) (*first revision*).

§Specification for cotton seed flour (expeller pressed) (*first revision*).

||Specification for edible full fat soya flour.

¶Specification for edible sesame flour (expeller pressed).

**TABLE 1 REQUIREMENT FOR TEXTURED PLANT
PROTEIN FOODS (TPPF)**

(Clause 3.6)

SL No.	CHARACTERISTIC	REQUIREMENT	METHOD OF TEST, REF TO
(1)	(2)	(3)	(4)
i)	Protein, percent by mass, <i>Min</i>	45	IS : 7219-1973*
ii)	Moisture, percent by mass, <i>Max</i>	6.0	Appendix A of IS : 1011-1981†
iii)	Calories per 100 gm, <i>Min</i>	340	By computation from proximate composition
iv)	Total ash, percent by mass, <i>Max</i>	7.0	Appendix E of IS : 1547-1968‡
v)	Acid insoluble ash, percent by mass, <i>Max</i>	0.25	Appendix E of 1011-1981†
vi)	Crude fibre (on dry basis), percent by mass, <i>Max</i>	3.50	Appendix A of IS : 1656-1969§
vii)	Total bacterial count, per g, <i>Max</i>	50 000	IS : 5402-1969
viii)	Coliform count, per g, <i>Max</i>	10	IS : 5401-1969¶
ix)	<i>Salmonella</i> , bacteria	Nil	IS : 5887 (Part III)-1976**

*Method for determination of protein in foods and feeds.

†Specification for biscuits (*second revision*).

‡Specification for infant milk foods (*first revision*).

§Specification for processed cereals weaning foods (*first revision*).

||Method for standard plate count of bacteria in food stuffs.

¶Methods for detection and estimation of coliform bacteria in foodstuffs.

**Methods for detection of bacteria responsible for food poisoning: Part III Isolation and identification of *salmonella* & *shigella*.

4. PACKING

4.1 The TPPF shall be packed in clean, sound containers made of tinplate, cardboard cartons having a strong water-proof lining or of any other material agreed to between the purchaser and the vendor in such a way as to protect these from crumbling, contamination and absorption of moisture.

4.2 The product may be packed in any suitable quantity from 10 to 1 000 grams depending upon the vendor and purchaser agreement. The product may also be packed in large size tin container of 5 kg, 10 kg or 20 kg. These containers shall have a polyethylene lining to protect the product from coming in contact with the tin surface of the container.

5. MARKING

5.1 The following particulars shall be marked or labelled on each container:

- a) Protein and calories per 100 gm;
- b) Name of the material and trade name or brand name; if any;
- c) Description according to shape and size;
- d) Name and address of the manufacturer;
- e) Batch or code number;
- f) Net mass of the product;
- g) Other labelling requirements according to provision of the *Standards of Weights and Measures (Packaged Commodities) Rules, 1977.*

5.1.1 The container may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

6. SAMPLING

6.1 Representative samples of the material shall be drawn as prescribed in Appendix A of IS : 9487-1980*.

7. TESTS

7.1 Tests shall be carried out as prescribed in **3.2, 3.3, 3.4, 3.5 and 3.6.**

7.2 Quality of Reagents — Unless otherwise specified, pure chemical and distilled water (*see IS : 1070-1977†*) shall be employed in tests.

NOTE — 'Pure chemicals' shall mean chemicals that do not contain impurities which affect the results of analysis.

*Specification for 'ready-to-eat' protein-rich extrude foods.

†Specification for water for general laboratory use (*second revision*).

A P P E N D I X A

(Clause 3.3)

WATER ABSORPTION CAPACITY TEST**A-1. APPARATUS****A-1.1 Beakers** — 200 ml capacity.**A-1.2 Balance** — 10-mg accuracy.**A-1.3 Measuring Cylinder** — 25-ml capacity.**A-1.4 Hot Plate****A-2. METHOD**

A-2.1 Weigh 10 grams of sample in a 200-ml beaker and add 100 ml water to it. Heat the water to simmering for 10 minutes. Cover the beaker with a wire gauze and clean the water. Weigh the hydrated product and calculate the water absorption capacity.

A-3. CALCULATION

$$\text{Water absorption capacity} = \frac{V}{M}$$

where

 V = maximum volume of water absorbed ($A - M$), M = mass in g of dry sample, and A = mass in g of hydrated product.**A P P E N D I X B**

(Clause 3.4)

TEXTURE STABILITY TEST**B-1. METHOD**

B-1.1 Take 100 g of sample and hydrate with excess amount of cold water for 1 hour. Retort for 30 min at 120°C. Drain off excess liquid and grind in a meat grinder through 3 mm plate. Spread 100 g portion of ground material evenly in a 20 cm diameter 850-micron IS Sieve [see IS : 460 (Part I)-1978*] and spray rinse with cold water for 1 minute. Shake off excess water. At least 35 percent of the material (from the 100 g sample) shall remain on the screen of the sieve.

*Specification for test sieves: Part I wire cloth test sieves (second revision).

(Continued from page 2)

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INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

QUANTITY	UNIT	SYMBOL
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

QUANTITY	UNIT	SYMBOL
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

QUANTITY	UNIT	SYMBOL	DEFINITION
Force	newton	N	1 N = 1 kg.m/s ²
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m ²
Frequency	hertz	Hz	1 Hz = 1 c/s (s ⁻¹)
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m ²

AMENDMENT NO. 1 DECEMBER 1998
TO
**IS 10038 : 1981 SPECIFICATION FOR TEXTURED
PLANT PROTEIN FOODS PREPARED BY EXTRUSION
COOKING**

(*Page 5, clause 3.6.3, lines 3 and 4*) — Substitute ‘methods prescribed in Appendix B and C of IS 4876 : 1986§’ for ‘method prescribed in Appendix A of IS 4874 : 1968§’.

(*Page 5, foot-note*) — Substitute ‘Specification for edible cottonseed flour (solvent extracted) (first revision)’ for ‘Specification for cotton seed flour (expeller pressed) (first revision)’.

[*Page 6, Table 1, Sl No. (ii), col 4*] — Substitute ‘Appendix B of IS 4684 : 1975†’ for ‘Appendix A of IS 1011 : 1981†’.

[*Page 6, Table 1, Sl No. (iv), col 4*] — Substitute ‘Appendix D of IS 4684 : 1975†’ for ‘Appendix E of IS 1547 : 1968‡’.

[*Page 6, Table 1, Sl No. (v), col 4*] — Substitute ‘Appendix E of IS 4684 : 1975†’ for ‘Appendix E of IS 1011 : 1981†’.

[*Page 6, Table 1, Sl No. (vi), col 4*] — Substitute ‘Appendix H of IS 4684 : 1975†’ for ‘Appendix A of IS 1656 : 1969§’.

(*Page 6, Table 1, foot-notes*) — Delete the following references:

‘†Specification for biscuits (second revision).’

‘‡Specification for infant milk foods (first revision).’

‘§Specification for processed cereals weaning foods (first revision).’

and insert the following reference:

‘†Specification for processed cereals weaning foods (first revision).’

(*Page 7, clause 5.1.1*) — Substitute the following for the existing:

‘5.1.1 BIS Certification Marking

The product may also be marked with the Standard Mark.

5.1.1.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made thereunder. Details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.’